Total No. of Questions—12]　　　　[Total No. of Printed Pages—4+2

S.E. (Instru. & Control) (First Semester) EXAMINATION, 2011

FUNDAMENTALS OF INSTRUMENTATION

(2008 PATTERN)

Time : Three Hours　　　　　　　　**Maximum Marks : 100**

N.B. :— (*i*) Answer *three* questions from Section I and *three* questions from Section II.

(*ii*) Answers to the two Sections should be written in separate answer-books.

(*iii*) Neat diagrams must be drawn wherever necessary.

(*iv*) Figures to the right indicate full marks.

(*v*) Assume suitable data, if necessary.

SECTION I

1. (*a*) What do you mean by input impedance and output impedance of an instrument ? Also explain impact of loading on measurement. [8]

(*b*) Solve the following :

(*i*) Full scale reading of voltmeter is 100 V. The accuracy of voltmeter is specified as ±1% of true value. What is probable range of reading shown by voltmeter while measuring voltage of 50 V ? [4]

P.T.O.

(*ii*) A voltmeter has a uniform scale with 200 divisions, the full scale reading is 200 V and 1/10 of a scale division can be estimated with fair degree of certainty. Determine the resolution of instrument. [4]

Or

2. (*a*) Explain general documented procedure for calibration of equipment. [8]

(*b*) A 100 V range voltmeter is connected across the terminals A and B of the circuit shown in Fig. 1. Find the reading of voltmeter under open circuit and loaded conditions. Find the accuracy and loading error. The voltmeter has a resistance of 1200 kΩ. [8]
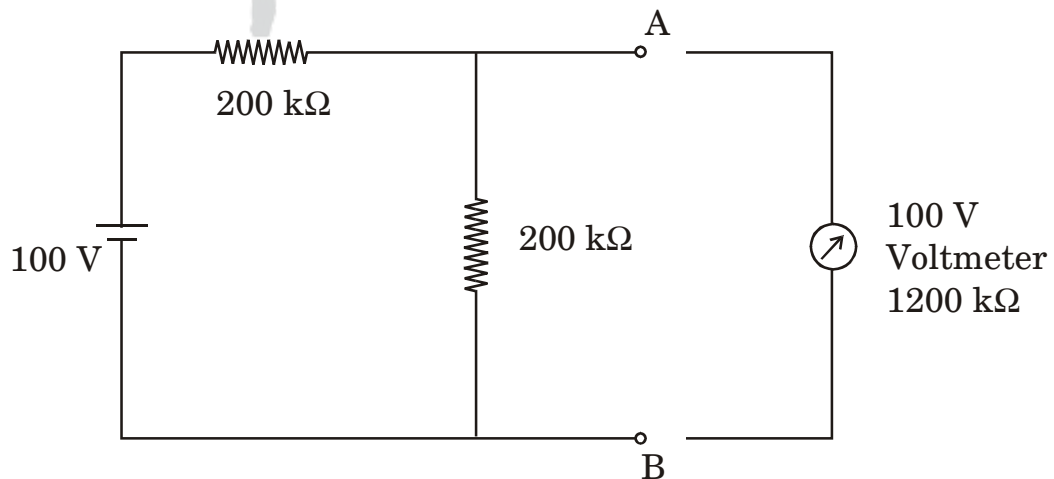

Fig. 1

3. (*a*) Explain the construction and working of attraction type and repulsion type of moving iron instrument. [8]

(*b*) Explain the construction and working of Single Phase Energy-meter. [8]

Or

4. (*a*) Explain the construction and working of self balancing type of potentiometer. [8]

(*b*) With the help of neat diagram explain the working of d'Arsonval Galvanometer. [8]

5. (*a*) Derive the bridge balancing condition in Wheatstone bridge. [8]

(*b*) What are the limitations of Wheatstone bridge ? [2]

(*c*) The four arms of Maxwell's capacitance bridge at balance are : [8]

arm ab – an unknown inductance L_1 having resistance of R_1

arm bc – a resistance of 1000 Ω

arm cd – a capacitor of 0.5 µF in parallel with resistance of 1000 Ω

arm da – resistance of 1000 Ω

Find unknown inductance and its resistance.

Or

5. (*a*) In Wheatstone bridge show that :

$$\theta = \frac{SiES\Delta R}{(R_0 + G)(R + S)^2}$$

where :

θ = Deflection of Galvanometer

E = Supply voltage of bridge

ΔR = Change in the unknown resistance arm

R_0 = The Thevenin equivalent of the bridge

G = Resistance of Galvanometer

R, S = Arms of the bridge. [9]

(*b*) Explain how frequency is measured by Wien bridge and also show that in Wien bridge [9]

$$f = \frac{1}{2\pi RC}$$

SECTION II

7. (*a*) Write down specifications of Digital Multimeter. Explain any *two* specifications in detail. [8]

(*b*) Write a short note on Digital Kilowatt Hour Meter. [8]

Or

8. (*a*)   Explain each block in detail involved in measurement of temperature digitally. [8]

(*b*)   With the help of neat block diagram explain the working of Digital Tachometer with typical specifications. [8]

9. (*a*)   Draw the basic block diagram of CRO. Explain in detail the working of Delay Line. [8]

(*b*)   Explain how phase can be measured in Y-t and X-Y mode with diagrams using CRO. [8]

(*c*)   List the advantages of Digital Storage Oscilloscope. [2]

Or

10. (*a*)   Explain how frequency can be measured using Z-modulation. [4]

(*b*)   Calculate the period and frequency of the waveform shown in Fig. 2 when the Time/Div knob is set to 2 µsec/cm. [4]
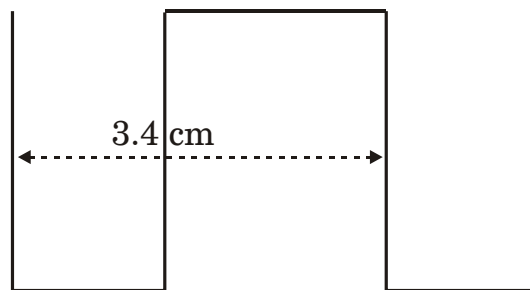

Fig. 2

(*c*) List the various controls on the front panel of a CRO. State the function of various controls on the front panel of a CRO. [10]

11. (*a*) Explain the difference between Virtual Instruments and traditional Instruments with block diagram. [8]

(*b*) Write a note on X-Y recorder. [8]

Or

12. (*a*) Write a note on multichannel recorder. [8]

(*b*) Explain the block diagram of function generator in detail. [8]